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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,560	03/31/2004	Panya Wongsenakhum	NOVLP096/NVLS-2902	7130
22434	7590	07/12/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP			ESTRADA, MICHELLE	
P.O. BOX 70250			ART UNIT	
OAKLAND, CA 94612-0250			PAPER NUMBER	

2823

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/815,560

Applicant(s)

WONGSENAKHUM ET AL

Examiner

Michelle Estrada

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2005.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.  
4a) Of the above claim(s) 34-39 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-16 and 21 is/are rejected.  
7) ☒ Claim(s) 17-20 and 22-33 is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 31 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 8/30/04, 2/14/05.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election with traverse of the first species (claims 1-33) in the reply filed on 6/16/05 is acknowledged. The traversal is on the ground(s) that claim 34 recites "exposing the substrate to a silane", this could involve "depositing a gas phase reducing agent onto the substrate to form a layer of reducing agent on the substrate". This is not found persuasive because it is another species which requires silane and two-step of forming the tungsten nucleation layer. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

The requirement is still deemed proper and is therefore made FINAL.

### ***Claim Objections***

Claim 15 is objected to because of the following informalities:

In claim 15, line 1, it appears that --the-- should be inserted after "wherein".

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 6-13, 15, 16 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Kori et al. (6,551,929).

Re claim 1, Kori et al. disclose: (a) positioning the substrate (42) in the reaction chamber; (b) exposing the substrate to a boron-containing species to form a boron-containing layer (Col. 8, lines 24-27); (c) contacting the boron-containing layer with a tungsten-containing precursor to form a tungsten nucleation layer (Col. 5, lines 19-50); and (d) depositing a bulk tungsten layer over the tungsten nucleation layer to form a tungsten film (Col. 6, lines 44-47).

Re claim 2, Kori et al. disclose wherein the reaction chamber comprises multiple stations.

Re claim 6, Kori et al. disclose wherein the thickness of the tungsten nucleation layer ranges between about 10 angstroms and about 100 angstroms, which is within the recited range of claim 6 (10-30 Å).

Re claim 7, Kori et al. disclose further comprising after (b) and before (c), and after (c) and before (d), purging the reaction chamber (See fig. 13).

Re claim 8, Kori et al. disclose wherein purging the reaction chamber comprises flowing carrier gas through the reaction chamber (Col. 5, lines 30-35).

Re claim 9, Kori et al. disclose wherein the carrier gas comprises nitrogen (Col. 5, lines 30-35).

Re claim 10, Kori et al. disclose wherein the substrate temperature during (b) and (c) is between 250 °C and about 450 °C (Col. 6, lines 15-17), which is within the range recited of claim 10 (200-475 °C).

Re claim 11, Kori et al. disclose wherein the reaction chamber pressure during (b) and (c) is between 1 Torr and about 10 Torr (Col. 6, line 32), which is within the range recited of claim 11 (1-350 Torr).

Re claim 12, Kori et al. disclose where the boron-containing species is a borane (Col. 8, lines 33-34).

Re claim 13, Kori et al. disclose wherein the borane is diborane ( $B_2H_6$ ) (Col. 8, lines 33-34).

Re claim 15, Kori et al. disclose wherein the tungsten-containing precursor is  $WF_6$  (Col. 5, line 25).

Re claim 16, Kori et al. disclose wherein (c) occurs for a time period sufficient to consume substantially all of the boron in the boron-containing layer (Col. 5, lines 35-50).

Re claim 21, Kori et al. disclose wherein (d) involves using a CVD process (Col. 6, lines 41-43).

***Claim Rejections - 35 USC § 103***

Claims 3-5 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kori et al. as applied to claims 1, 2, 6-13, 15, 16 and 21 above, and further in view of the following comments.

Kori et al. do not specifically disclose wherein the sheet resistance of the tungsten film is no greater than about  $15\ \mu\Omega\text{-cm}$ ; wherein the thickness of the tungsten film ranges between about 5 Å and about 1,000 Å; wherein the thickness of the tungsten film is no greater than about 500 Å; and wherein the boron-containing layer formed in (b) has a thickness of between about 3 and 15 Å.

Re claim 3, the sheet resistance of the tungsten film is expected to be no greater than about  $15\ \mu\Omega\text{-cm}$  since the process parameters recited are within the range Kori's et al. process.

One of ordinary skill in the art would have been led to the recited tungsten thickness and the boron-containing layer thickness through routine experimentation to achieve a desired device dimension, device associated characteristics and device density on the finished wafer. In addition, the selection of the tungsten thickness and the boron-containing layer thickness, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not

Art Unit: 2823

overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed tungsten thickness and the boron-containing layer thickness or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen tungsten thickness and the boron-containing layer thickness or upon another variable recited in a claim, the Applicant must show that the chosen tungsten thickness and the boron-containing layer thickness are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

### ***Allowable Subject Matter***

Claims 17-20 and 22-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: there is no disclosure in the prior art alone or in combination of the limitations recited in claims 17-20 and 22-33.

Art Unit: 2823

**Conclusion**

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is 571-272-1858. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2800.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Michelle Estrada  
Patent Examiner  
Art Unit 2823

ME  
July 11, 2005